

What is claimed as new and what is desired to secure by Letters Patent of the United States is:

1. In a physical separator having a D.C. voltage altering device attachable between a D.C. high voltage power source and a physical separator for improving separation efficiency thereof, said device comprising:

a first spark induction power conditioner including

a first electrode connectable to a high voltage D.C. power source; and

a second electrode spaced from said first electrode and forming a discharging gap therebetween, said second electrode being connectable to a predetermined section of a physical separator, at least one of said electrodes being selectively positionable for altering spatial distance between said electrodes;

said power conditioner inducing a predetermined large amplitude, high frequency current ripple to said second electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

2. The device of claim 1, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a corona wire electrode of a physical separator to more effectively pin non-conducting particulate materials on a movable surface.

3. The device of claim 1, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a static lifting electrode of a physical separator to more effectively lift conducting particulate materials from a movable surface.

4. The device of claim 1, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a corona wire electrode of a physical separator that is connected in series with a static lifting electrode of a

physical separator to more effectively separate non-conducting particulate materials from conducting particulate materials.

5. The device of claim 1, further comprising:

a second spark induction power conditioner spaced from said first spark induction power conditioner and including

a third electrode connectable to a high voltage D.C. power source; and

a fourth electrode spaced from said third electrode and forming a discharging gap therebetween, said fourth electrode being connectable to a predetermined section of a physical separator, at least one of said electrodes being selectively positionable for altering spatial distance between said third and fourth electrodes;

said second power conditioner inducing a predetermined large amplitude, high frequency current ripple to said fourth electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

6. The device of claim 5, wherein one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a corona wire electrode of a physical separator and another one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a static lifting electrode of a physical separator, said fluctuating voltage fields associated with said first and second spark induction conditioners being independently adjustable and not in phase.

7. The device of claim 1, wherein said first spark induction power conditioner further comprises:

a base having a channel formed therein and for housing said first and second electrodes;

a cover removably attachable to said base; and

a plurality of fastening members being selectively engageable with said first and second electrodes and for maintaining same at selected stable positions.

8. The device of claim 5, wherein said second spark induction power conditioner further comprises:

a base having a channel formed therein and for housing said first and second electrodes;

a cover removably attachable to said base; and

a plurality of fastening members selectively engageable with said third and fourth electrodes and for maintaining same at selected stable positions.

9. In a physical separator having a D.C. voltage altering device attachable between a D.C. high voltage power source and a plate of an electrostatic separator for improving separation efficiency thereof, said device comprising:

a first spark induction power conditioner including

a first electrode connectable to a high voltage D.C. power source; and

a second electrode spaced from said first electrode and forming a discharging gap therebetween, said second electrode being connectable to a plate electrode of a physical separator, at least one of said electrodes being selectively positionable for altering spatial distance between said electrodes;

said power conditioner inducing a predetermined large amplitude, high frequency non sine wave current ripple to said second electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

10. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a positive plate electrode of a physical separator to more effectively attract negatively charged particulate materials to a positive plate electrode.

11. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a negative plate electrode to more effectively attract positively charged particulate materials to a negative plate electrode.

12. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a grounded plate electrode of a physical separator.

13. The device of claim 9, further comprising:

a second spark induction power conditioner spaced from said first spark induction power conditioner and including

a third electrode connectable to a high voltage D.C. power source; and

a fourth electrode spaced from said third electrode and forming another discharging gap therebetween, said fourth electrode being connectable to another plate electrode of a physical separator, at least one of said electrodes being selectively positionable for altering spatial distance between said electrodes;

said power conditioner inducing a predetermined large amplitude, high frequency non sine wave current ripple to said fourth electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

14. The device of claim 13, wherein one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a positive plate electrode of a physical separator and another one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a negative plate electrode of a physical separator, said fluctuating voltage fields associated with said first and second spark induction conditioners being independently adjustable and not in phase.

15. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a plurality of positive plate electrodes of a physical separator.

16. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a plurality of negative plate electrodes of a physical separator.

17. The device of claim 13, wherein said first and second spark induction power conditioners are connectable in series between a high voltage power source and a plurality of positive plate electrodes of a physical separator respectively.

18. The device of claim 13, wherein said first and second spark induction power conditioners are connectable in series between a high voltage power source and a plurality of negative plate electrodes of a physical separator respectively.

19. The device of claim 9, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a curved plate electrode of a physical separator.

20. The device of claim 13, wherein said second spark induction power conditioner further comprises:

- a base having a channel formed therein and for housing said first and second electrodes;

- a cover removably attachable to said base; and

- a plurality of fastening members selectively engageable with said third and fourth electrodes and for maintaining same at selected stable positions.

21. A physical separator for separating mixtures of particulate materials, said separator comprising:

- an electrode assembly; and

a D.C. voltage altering device attachable between a high voltage D.C. power source and said separator for improving separation efficiency thereof, said device including a spark induction power conditioner having

a first electrode connectable to a high voltage D.C. power source; and

a second electrode spaced from said first electrode and forming a discharging gap therebetween, said second electrode being connectable to a predetermined section of said separator, at least one of said electrodes being selectively positionable for altering spatial distance between said electrodes;

said power conditioner inducing a predetermined large amplitude, high frequency current ripple to said second electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

22. The separator of claim 21, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a corona wire electrode of said separator to more effectively pin non-conducting particulate materials on a movable surface.

23. The separator of claim 21, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a static lifting electrode of said separator to more effectively lift conducting particulate materials from a movable surface.

24. The separator of claim 21, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a corona wire electrode of said separator that is connected in series with a static lifting electrode of said separator to more effectively separate non-conducting particulate materials from conducting particulate materials.

25. The separator of claim 21, further comprising:

a second spark induction power conditioner spaced from said first spark induction power conditioner and including

a third electrode connectable to a high voltage D.C. power source; and

a fourth electrode spaced from said third electrode and forming a discharging gap therebetween, said fourth electrode being connectable to another predetermined section of said separator, at least one of said electrodes being selectively positionable for altering spatial distance between said third and fourth electrodes;

said second power conditioner inducing a predetermined large amplitude, high frequency current ripple to said fourth electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

26. The separator of claim 25, wherein one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a corona wire electrode of said separator and another one of said first and second spark induction power conditioners is connectable in series between a high voltage power source and a static lifting electrode of said separator, said fluctuating voltage fields associated with said first and second spark induction conditioners being independently adjustable and not in phase.

27. The separator of claim 21, wherein said first spark induction power conditioner further comprises:

a base having a channel formed therein and for housing said first and second electrodes;

a cover removably attachable to said base; and

a plurality of fastening members being selectively engageable with said first and second electrodes and for maintaining same at selected stable positions.

28. The separator of claim 25, wherein said second spark induction power conditioner further comprises:

a base having a channel formed therein and for housing said first and second electrodes;

a cover removably attachable to said base; and

a plurality of fastening members selectively engageable with said third and fourth electrodes and for maintaining same at selected stable positions.

29. A physical separator for separating mixtures of particulate materials, said separator comprising:

an electrode assembly; and

a D.C. voltage altering device attachable between a high voltage D.C. power source and said separator for improving separation efficiency thereof, said device including a spark induction power conditioner having

a first electrode connectable to a high voltage D.C. power source; and

a second electrode spaced from said first electrode and forming a discharging gap therebetween, said second electrode being connectable to a predetermined section of said separator, at least one of said electrodes being selectively positionable for altering spatial distance between said electrodes and adjusting said discharging gap;

said power conditioner inducing a predetermined large amplitude, high frequency non-sine wave current ripple to said second electrode for creating a fluctuating voltage and fluctuating electrostatic field and maintaining continuous current flow through said gap without reversal of polarity.

30. The separator of claim 29, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a positive plate electrode of a physical separator to more effectively attract negatively charged particulate materials to a positive plate electrode.

31. The separator of claim 29, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a



negative plate electrode to more effectively attract positively charged particulate materials to a negative plate electrode.

32. The separator of claim 29, wherein said first spark induction power conditioner is connectable in series between a high voltage power source and a grounded plate electrode of said separator.